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WATER RUNOFF STUDY
FOR MAIN DRAINAGEWAYS AND OUTLETS

GEORGETOWN COUNTY, SOUTH CAROLINA

Prepared under sponsorship of
GEORGETOWN COUNTY
GEORGETOWN DRAINAGE COMMISSION
and
GEORGETOWN SOIL AND WATER CONSERVATION DISTRICT
in cooperation with the
U. S. Department of Agriculture
Soil Conservation Service

June 1979

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D DESIGN DATA" SHEETS

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1. The ... involved should be known.

2. Ref ... MAP SHEETS" and locate the area on

3. Thi ... ber of the map sheet showing the dra ... k.

4. Tur ... nd locate the area desired on thi ... the map will show the "Planning Are ... Lateral number such as M-1, L-1

5. Turn to this planning area number in the ENGINEERING AND DESIGN DATA Sheets and locate the Main or Lateral desired on this sheet.

Each time a lateral enters the main canal, the Main is broken into a section at this point. Laterals also are broken into sections at points where other laterals enter them. This was necessary to design each section to carry the flow increase. Also, it was necessary to break mains and laterals into sections at state and county road crossings in order to design the proper size culverts and bridges at these points.

It must be kept in mind that the information given in the "ENGINEERING AND DESIGN DATA" Sheets begins at the upper end of each watershed and proceeds, section by section, to the outlet.

<u>EXAMPLE</u>: To find information for the ditch crossing U. S. Highway 701 just south of Plantersville refer to the index to Atlas Sheets. The index indicates that the point where this ditch crosses Highway 701 can be found on Sheet 5 at the back of the report.

Sheet 5 designates this ditch as main number 4 (M4) in Planning Area 2 and shows it was designed in four segments A, B, C, and D.

A general description of Planning Area 2 is found in the report and the details of the ditch are in the Engineering and Design Data Table.

Beginning at the upstream end of the ditch, M4A, in the table for Area 2 and proceeding downward toward the outlet end, it is found that it crosses Highway 701 at the end of Segment M4A. The various criteria for the engineering and design estimates may be obtained from the table for each segment.

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FOREWORD

In 1526 a group of Spaniards settled in the Winyah Bay area of South Carolina—the first settlement by Europeans on the mainland of the United States. The settlers, however, were driven out in less than a year by disease and savage indians. Many years later, around 1700, rice planters began to settle along the several rivers that outlet into the ocean through this bay area; here they employed a unique system of irrigation based on the rise and fall of the tides which fluctuated the river levels allowing them to control flooding of the rice fields.

In 1729 the area on the bay itself was laid out which was called Prince George Parish, in honor of the Prince of England who later became King George II. In the few years that followed, the parish was further developed and soon became known as Georgetown.

Georgetown increased in importance as a shipping center with large quantities of lumber and naval stores, rice, indigo and later tobacco and cotton passing through it. It was on North Island near Georgetown that the Marquis de Lafayette landed, Friday the 13th of June, 1777, to give his assistance to the colonial cause of freedom during the American Revolution.

Since these first settlements were made along the rivers near Georgetown about 1700 to establish homesteads and produce crops, the existing problem of imperfect internal and surface drainage has affected the growth and development of this area of South Carolina.

The higher areas of land were used by the first settlers for homesteads and for small fields to produce food crops. Low, wet lands other than rice field areas were left in their natural state. As settlements grew and more land was needed for farming operations, it was necessary to install some type of drainage system on individual farms. These drainage systems were usually excavated by hand, many with slave labor. As a result, these small ditches were inadequate and only partially met the drainage needs. The lack of knowledge of drainage systems and the availability of only hand tools retarded the design and installation of complete systems.

With the increase in land use and particularly with the advent of modern construction machinery such as the bulldozer, dragline and backhoe, it became relatively easy to excavate larger canals and outlet ditches needed for adequate drainage. Even with the new machines, much of the drainage work installed has been the result of expediency incident to population growth and did not follow a well developed plan of action. Improving the quantity and quality of agricultural crops and providing well drained areas for home sites are essential to perpetuate economic growth of a community; providing additional drainage is necessary as a first step toward enhancing the environment and increasing income for its people.

The Water Runoff Study for Main Drainageways and Outlets in Georgetown County is the direct result of foresight and interest of the county authorities and the Georgetown Soil and Water Conservation District Commissioners who saw the need for a plan to enhance the potential development of the county. Agencies at all levels of government - city, county, state, and federal - as well as private enterprise and numerous individuals, cooperated in the development of the plan. The Georgetown County Commissioners appropriated funds for the local share of the cost of the study including the publication of this report. Technical assistance was furnished by the Soil Conservation Service.

The plan and information contained in this report will be of interest to organizations concerned with land use in the county. The cooperation of other agencies, groups and individuals in the use of this report is encouraged.

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WATER RUNOFF STUDY FOR MAIN DRAINAGEWAYS AND OUTLETS GEORGETOWN COUNTY, SOUTH CAROLINA

INTRODUCTION AND SCOPE

One of the significant needs for efficient use and development of the land resources in Georgetown County is the provision for the management of excess rainfall runoff. The lack of adequate drainageways is detrimental to existing and future land use management especially in the upland areas of the county. Flooding results in frequent and costly damage to natural wildlife habitats, agricultural crops, timberland growth and public and private property. Flooding also disrupts facilities in urban and industrial areas. In recent years the need for drainage has affected and virtually prevented housing development progress in many areas where septic tank drain fields were to be installed. The need to reduce flooding through improvement of drainageways and outlets is a problem that requires priority attention.

The development of a water disposal plan for an entire county should logically begin with a study of the needs of the main drainageways and outlets to remove excess water.

The purpose of this study is to point out the extent and severity of the excess water problems and to estimate the number, size and excavation quantities of water disposal systems to convey excess water properly to adequate outlets.

The engineering and design data in this report are based on reconnaissance surveys, information presently available, and knowledge gained by long experience in planning and establishing drainage facilities in the county. These data are adequate for the purpose of determining preliminary designs and preliminary cost estimates based on present land use, but are not adequate, however, for the preparation of final construction plans, designs and costs. The data in this report can be used by engineers as guides to determine types of additional surveys and investigations needed to secure detailed information for final design.

A discussion of some of the principal criteria used in sizing channels is included, as well as technical references which can supply information for final design.

Flooding adversely affects farmsteads, timberland, planting areas, highways, and utilities.

FACTORS AFFECTING WATER DISPOSAL

The location of Georgetown County, on the Atlantic Seaboard, along with the county's physical features result in complex drainage problems. Physical features that contribute to these problems are topography, rivers and tides, rainfall, soils, and land use and ownership, all of which are interrelated. A brief discussion of how these features affect the water disposal, and a description of the existing drainage system follows.

TOPOGRAPHY

Topography is a severely limiting factor, affecting excess water disposal. Elevations range from tidal marsh along the coast to 64 feet above sea level in the northern corner of the county.

Upland areas therefore are rather limited between a large number of bays, river flood plains and tidal marshes. The land is generally level with slight undulations although potential outlets are available.

"Flopped" tobacco - a high value crop loss is caused by lack of proper drainage in an agricultural area.

RIVERS AND TIDES

Georgetown County is covered with a network of rivers and streams and large bay areas that have a significant effect on the drainage pattern.

Almost paralleling the coast, the Waccamaw River runs southwestward out of Horry County to Georgetown and into Winyah Bay. The Great Pee Dee River forms a portion of the northern boundary of the county and turns southward to converge with the Waccamaw at Georgetown. The Black River runs southeastward across the midsection of the county and joins the Great Pee Dee River a few miles above its confluence with the Waccamaw.

The Sampit River also cuts southeastward through the county, emptying into the upper end of Winyah Bay just south of Georgetown. The entire southwestern boundary of the county is formed by the South Santee River. The North Santee River parallels the South Santee approximately 2 miles inside the county.

In addition to these large rivers and their tributaries, several large bays affect large areas of land. These include Tupelo Bay, Carvers Bay, Gapway Bay, Little Kilsock Bay, Big Kilsock Bay and White Oak Bay.

All of these rivers and bays affect the county's drainage. The main rivers are well defined; their water levels are generally at lower elevations and provide an outlet for higher ground drainage. However these rivers and other large creeks are constantly a threat to adjacent low-lying areas. After heavy rainfall periods,flood water overflow inundates the areas and blocks tributary outlets. A sizeable area of the county is affected in this manner.

A large number of old rice fields are located along these rivers where they were originally planted by early settlers who used a unique system of irrigating the fields. River marsh areas affected by tidal flow, were controlled by dikes and use of wooden "trunks" and flap gates to maintain the water level for the rice cultivation. Excess runoff water was drained at low tide; inflow was allowed as needed.

Many of these old diked fields, with their water controls, have been maintained or renovated for a number of years and utilized for wildlife areas, mainly duck fields.

This report does not include any study of the main streams. It does include a study of the tributaries to relieve adjacent lands of flooding as quickly as possible after heavy rains when river floods recede.

Highways and woodlands need adequate main outlets for excess rainfall.

RAINFALL

U. S. Weather Bureau records, Table No. 1, show monthly and annual totals of rainfall for Georgetown and vicinity. The average annual rainfall of 51 inches would not cause a serious drainage problem if it were evenly distributed. The most serious drainage problems occur in low flat areas which are flooded by high intensity, short duration rain storms.

The design of water disposal systems and supporting structures are related to the amount of runoff that can be expected from storms of differing intensities and durations. (See Tables Nos. 2 & 3)

SOILS

According to the Soil Survey for Georgetown County, a major percentage of the soils have excess water problems. This fact points out the need for management of excess water in the county. It would not be desirable or practical to provide drainage for all of the wet soils in the county; the degree of drainage needed is dependent on the type of soil and the land use.

Soils have characteristics which influence the need for and the degree of drainage. Some of the more important characteristics are slope, texture, infiltration, permeability, structure, depth, waterholding capacity and depth to water table. Fine (clayey) textured soils have slow internal water movement and will not readily respond to deep ditches. Shallow ditches to remove surface water provide the best practical means for improvement of these soils for most uses. Sandy soils, having high or fluctuating water tables, respond to subsurface drainage but present some problems in the design of stable open ditches.

A knowledge of the characteristics and the engineering properties of the soils is essential in planning, designing and constructing adequate runoff water management systems.

TABLE NO. 1
TOTAL INCHES OF PRECIPITATION
GEORGETOWN, SOUTH CAROLINA

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann'l
1941	2.28	2.03	4.52	2.35	.15	10.75	9.39	5.57	.81	1.73	1.76	9.13	50.47
1942	2.34	2.70	5.74	1.35	3.25	8.36	3.73	3.16	2.18	.26	.30	2.74	36.11
1943	4.41	.64	6.02	3.77	1.84	2.28	5.23	3.83	6.31	.00	1.71	3.93	39.97
1944	3.79	6.11	7.81	2.60	2.04	2.61	2.66	4.17	3.20	4.09	2.10	.69	41.87
1945	2.01	4.05	1.04	2.48	3.65	13.98	9.19	8.36	16.17	1.74	.24	5.22	68.13
1946	2.35	2.66	5.63	3.67	3.86	2.33	8.52	6.52	1.57	3.73	2.51	1.01	44.36
1947	1.61	.29	5.72	4.03	3.60	9.62	8.30	6.76	7.11	4.77	6.15	6.37	64.33
1948	3.55	4.31	8.04	3.59	7.92	2.80	6.73	6.09	5.62	2.80	7.04	3.79	62.28
1949	.72	4.94	2.39	3.23	4.20	6.04	5.94	8.01	5.14	.78	2.13	.94	44.46
1950	.83	.74	6.01	.43	3.66	2.79	14.46	7.07	11.31	2.80	.83	4.36	55.29
1951	.35	1.40	3.87	2.38	.40	6.42	2.83	1.32	7.05	.35	2.38	2.96	31.71
1952	.80	4.50	4.33	1.81	4.61	3.59	4.83	10.30	6.24	1.26	3.13	2.57	47.97
1953	2.61	5.07	7.95	1.11	4.66	2.99	4.59	12.83	7.59	.15	2.68	5.64	57.87
1954	1.92	1.65	2.99	.81	2.97	.44	6.27	1.75	4.66	9.66	1.22	2.96	37.30
1955	5.61	1.53	.91	3.68	3.99	4.37	3.13	9.53	11.17	2.04	2.26	1.19	49.41
1956	1.76	2.01	2.50	2.29	2.85	5.24	2.65	6.20	10.02	4.91	.80	.71	41.94
1957	1.89	3.96	6.93	1.02	2.56	3.28	7.33	5.79	7.16	1.40	4.02	4.12	49.46
1958	5.51	4.51	5.77	4.50	4.29	10.11	3.63	6.98	5.81	3.67	1.27	3.31	59.36
1959	2.49	4.34	6.85	1.59	2.03	3.97	10.68	6.60	13.81	8.41	2.16	3.54	66.47
1960	4.58	3.77	3.29	2.10	1.92	4.44	12.58	2.47	12.79	2.89	1.09	1.94	53.86
1961	1.44	4.76	5.24	7.83	8.24	5.70	11.98	6.35	4.66	4.86	3.13	1.96	66.15
1962	3.61	1.46	6.19	3.40	1.20	5.05	4.81	4.88	7.36	2.72	6.63	2.09	49.40
1963	2.82	5.78	1.73	1.11	3.42	5.23	5.00	1.84	2.35	3.02	3.69	1.49	37.48
1964	8.45	7.45	3.56	1.74	1.82	9.83	9.97	9.25	3.45	10.41	.93	6.72	73.58
1965	.93	9.02	8.10	2.52	1.07	8.18	7.85	5.65	2.00	2.34	1.17	1.09	49.92
1966	7.08	3.14	5.35	1.40	6.55	6.25	7.73	6.17	7.83	1.12	.30	4.89	57.81
1967	6.71	3.47	3.15	1.88	5.12	5.19	12.07	4.97	2.33	.86	1.38	3.76	50.89
1968	3.14	1.46	1.08	2.63	7.04	3.25	11.68	4.23	1.47	6.71	1.31	1.14	45.14
1969	2.48	1.47	2.85	3.97	1.83	10.18	3.93	3.25	4.47	1.06	6.73	3.71	45.93
1970	2.79	2.08	6.89	1.05	2.79	3.92	10.99	9.31	2.43	13.16	.41	2.17	57.99
1971	3.99	2.40	3.54	4.32	5.93	5.90	9.58	19.49	2.10	12.59	1.86	1.36	73.06
1972	4.21	3.95	2.32	.05	4.74	3.61	6.01	4.46	5.29	.12	7.43	4.57	46.76
1973	5.18	5.42	2.88	2.31	2.66	7.03	5.52	11.15	5.27	.47	.99	5.58	54.46
1974	2.10	5.12	2.70	.51	7.53	6.43	3.03	8.12	3.50	1.18	1.85	4.75	46.82
1975	4.61	3.62	4.23	3.15	5.49	5.21	7.19	6.23	6.28	1.18	2.15	4.78	54.12
1976	3.31	.59	2.97	.13	9.48	5.26	7.71	5.46	4.99	4.85	2.70	5.90	53.33
1977	3.48	1.93	4.60	1.24	3.54	4.97	7.71	4.46	2.37	4.66	2.44	5.10	46.50
1978	4.42	1.33	3.07	2.08	6.11	1.40	4.48	2.40	3.62	.81	3.14	3.70	36.56
Average Rainfall	3.21	3.31	4.44	2.37	3.92	5.50	7.10	6.34	5.72	3.41	2.47	3.47	51.28

From Rainfall Data, U. S. Weather Bureau - Georgetown 2 E Station

TABLE NO. 2
PRECIPITATION EXTREMES (1941-1978)
(INCHES)

	Maximum Monthly	Year	Minimum Monthly	Year
January	8.45	1964	.35	1951
February	9.02	1965	.29	1947
March	8.10	1965	.91	1955
April	7.83	1961	.05	1972
May	9.48	1976	.15	1941
June	13.98	1945	.44	1954
July	14.46	1950	2.65	1956
August	19.49	1971	1.32	1951
September	16.17	1945	.81	1941
October	13.16	1970	.00	1943
November	7.43	1972	.24	1945
December	9.13	1941	.69	1944

Rainfall Data, U. S. Weather Bureau - Georgetown 2 E Station

TABLE NO. 3
RAINFALL IN INCHES FOR SELECTED DURATIONS
GEORGETOWN COUNTY, SOUTH CAROLINA

	30 Min.	1 Hour	2 Hour	3 Hour	6 Hour	12 Hour	24 Hour
1 Year	1.4	1.8	2.1	2.3	2.6	3.2	3.7
2 Years	1.6	2.0	2.5	2.7	3.2	3.7	4.5
5 Years	2.0	2.6	3.1	3.5	4.2	5.0	5.7
10 Years	2.3	2.9	3.6	4.0	4.7	5.7	6.7
25 Years	2.6	3.3	4.1	4.5	5.4	6.5	7.7
50 Years	2.9	3.7	4.6	5.1	6.2	7.3	8.7
100 Years	3.2	4.0	5.1	5.6	7.0	8.3	9.7

From U. S. Weather Bureau, Technical Paper No. 40,
"Rainfall Frequency Atlas of the United States."

LAND USE AND OWNERSHIP

About 80 percent of the land in Georgetown County is in forests; a major portion commercial forests. A much smaller portion is devoted to farming crops of corn, soybeans, tobacco and cotton. Much of the land is occupied by large plantations that are primarily used as private hunting preserves. A number of these plantations also have raised some purebred cattle.

Changes in land use in recent years have had an adverse effect on water disposal in the county. One of the most significant of these is urbanization. Areas being developed for housing, shopping centers and industry in most instances have inadequate excess water disposal systems facilities. Most of the systems now in use were established to handle the woodland and agricultural needs of the areas. They are not adequate to handle the increased runoff resulting from urbanization. Roof tops, paved roads, compaction, raised water tables resulting from septic tanks and drain field installations, and elimination of some ditches during development, have all caused an increase in the amount of excess water to be disposed of.

Drainage culverts under driveways and roads in new as well as established subdivisions, are critical factors contributing to poor local drainage. Head losses alone, resulting from widespread use of underdesigned culverts create local flooding conditions.

As urbanization continues, the present water disposal systems will become increasingly inadequate to handle the increased runoff, and additional flooding will occur. After urbanization has taken place, it is extremely expensive and sometimes impossible to provide adequate water disposal. Regulations may be needed to insure that adequate water disposal plans are included in these areas during development.

Heavy rains and poor water disposal systems threaten housing areas and septic tank field drains.

Land ownership often is a factor in the installation of drainage improvements. Frequently it is necessary for one owner to go on another's property, or go through it, to obtain an outlet. In larger group projects it is necessary to cross a number of land owners to reach adequate outlets. In either case, it is imperative that right-of-way easements be obtained before work can be begun.

Excessive rainfall runoff, backed up in an undersized drain, floods a residential and commercial section of a town.

WILDLIFE

Proper drainage also plays an important part in another land use - wildlife management. Populations of game species such as deer, quail, turkey, and rabbits are enhanced in a safer and healthier wildlife environment provided in well drained areas. Unseasonably heavy rains can cause mass drowning of young animals and nestlings. Biting insect pests are reduced as a result of diminished breeding places in these areas where excess water is removed. Improvement of the habitat through proper water disposal allows greater natural food production. Seeded spoil banks not only control erosion but also provide food and cover, and travelways for wildlife.

Care should be taken, however, to protect certain wetland areas. Drainage of high value wetland sites is detrimental to wetland wildlife. Game species, such as wild ducks, geese, snipe, and some furbearers, depend heavily upon the water covered and water saturated areas for food and cover. Destruction of these areas through drainage could drastically reduce wetland wildlife species.

The discharge of dredged or fill material in inland waters and wetlands is regulated by the Federal Water Pollution Control Act Amendments of 1972. Prior to placing fill material in wetlands, application for a Section 404 permit should be made to the nearest district office of the U. S. Army Corps of Engineers who are assigned the responsibility for carrying out Section 404 of the regulations.

The South Carolina Wildlife and Marine Resources Department can provide information, evaluation, and assistance in planning water management practices in wetland areas.

EXISTING DRAINAGE SYSTEM

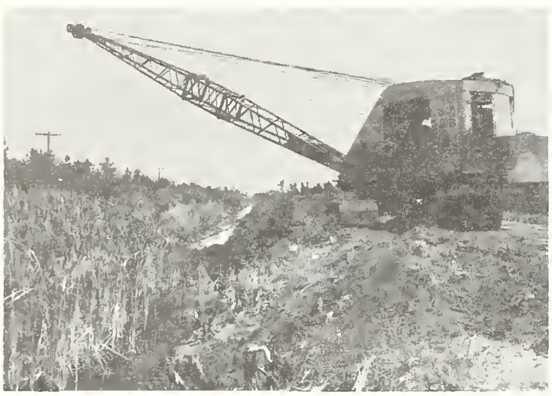
Existing canals are usually located in natural water courses. However in many instances, alignment is poor due to the fact that canals were located on existing property lines, cleared land borders, meandering branch runs, or other physical features that were inconsistent with efficient channel flow conditions.

With the exception of some recently excavated canals, many drainage systems in rural and urban areas generally lack depth and capacity, have very flat grades and inadequate outlets. Several ditches excavated in the northern part of the county in the early 1970's improved the natural drains and benefitted hundreds of acres of land in this area. While the capacity of these improved waterways is still generally good, there is a need for some maintenance, especially vegetative removal, to restore full flow. A number of other smaller drainage projects completed in recent years, as well as numerous natural waterways, that serve as outlets also need the same type of maintenance to restore full flow.

MAINTENANCE

Lack of adequate maintenance is a factor affecting the capacity of drainage canals and ditches. Most of the existing drainage canals in the county were dug by hand many years ago; some were dug or enlarged by the Works Progress Administration (WPA) in the 1930's;

clumsy floating dredges were used on some of the larger ones. These methods left nearly vertical side slopes with excavated material placed immediately next to the ditch. Access to practically all canals is restricted by high spoil banks which are covered by a heavy growth of trees and brush. Being continuous for long distances, these spoil banks prevent surface drainage, resulting in ponding behind the banks. The extent of economic and practical maintenance by machine is limited largely due to these spoil placement practices.



Old ditches can be brought back to full capacity and service by simple maintenance or enlarging.

EXCESS WATER DISPOSAL PRINCIPLES

This report presents a plan for the location and needed capacities of main drainageways based on present land use. This is, however, only a preliminary step in the establishment of a complete water disposal system. Further steps in designing the system will include the exact size, depth, and grade of each drainageway determined only by a more detailed investigation and survey by qualified individuals. In some locations, detailed investigations might prove that existing drainageways are adequate. Drainage systems are divided into two broad categories-surface drainage and subsurface drainage.

SURFACE DRAINAGE

Surface drainage systems provide for removal of excess water from the land surface to an outlet. Surface water can best be moved by shallow graded channels or by forming the land surface to a uniform slope. Surface drainage facilities are particularly applicable to soils having slow permeability rates. Surface drainage on these soils is used to prevent ponding in shallow depression areas and also to divert water from protected areas to natural or excavated channels.

SUBSURFACE DRAINAGE

Subsurface drainage removes water from beneath the surface of the soil by facilities which create a difference in hydraulic head. The resulting hydraulic head causes water to move through the soil to an outlet at a lower elevation. This may be accomplished by open ditch drains or by closed drains of tile or perforated tubing. Often a combination of open and closed drains is used for subsurface drainage. Open ditch drains sometimes have an added advantage in that they can remove both surface and subsurface water. Properly installed closed drains require very little maintenance. They can also be designed to remove surface water by providing protected drop inlets or catch basins that simulate small storm sewer systems.

The purpose of subsurface drainage is to lower the water table to a point where it will not interfere with plant growth or the use of the land for residential or other

purposes. The minimum depth below the surface at which water tables should be maintained depends on the purpose for which the land is to be used. Water tables, fluctuating from a lower level upward to or near the surface, may not be as great a problem for some agricultural uses as they would be in populated areas where construction of buildings, septic tanks, lawns and gardens, or streets would be damaged.

A ditch with good design section and managed spoil can serve as outlet for timberland, farmland and developed areas.

WATER RUNOFF SYSTEMS

The components of an excess water disposal system are as follows:

The Collection Segment is that part of the drainage system which first picks up water from the land. It may consist of shallow trapezoidal ditches having flat side slopes, V or W type ditches, bedded areas, or graded land surfaces.

The Disposal Segment receives water from the collection segment and conveys it, usually in an open channel or floodway to an outlet.

Generally this report concerns itself with the disposal segment of the drainage system.

The Outlet is the end point of any section of a drainage system beyond which the conveyance system no longer guides or controls the water it discharges.

EXCESS WATER REMOVAL REQUIREMENTS

The water disposal system should be designed so that flooding will not occur in critical parts of the watershed for a period of time sufficient to cause damage or disrupt utilities and services. For urban areas, design should provide for the removal of runoff from the design storm with a minimum of flooding. In agricultural areas, the degree of protection required by crops varies considerably, depending on their tolerance to the amount and duration of excess water. Truck crops are the most susceptible to damage from excess surface water, with damage occuring to some when flooded for the relatively short period of 24 hours or less. General crops such as corn and grain are less susceptible, with pasture being the least subject to water damage. Woodland areas are the least subject to damage from flooding for prolonged periods.

Poorly drained soils adversely affect the use of the land for most purposes. On agricultural land, high water tables restrict root depth; the soil temperature is lowered and air circulation is severely limited depending on the degree of soil saturation. Wet spots in the field delay farm operations and shorten the growing season.

In residential areas, poorly drained soils adversely affect the construction, maintenance and use of

roads and streets in addition to the harmful effects on ornamental plants, flower gardens and lawns. These soils also limit or prohibit the development of some areas, preventing the proper functioning of septic tanks or tile field drains and thus contribute to health hazards.

Adequately sized road culverts at lower elevations provide outlets for low lying drainage areas and subsurface water.

DESIGN CRITERIA

The design of excess water disposal systems and supporting structures is based largely on Hydrology and Hydraulics. This report is limited to the application of these sciences as they apply to water disposal systems. Data and detailed information on the design of the drainageways are tabulated on the pages following this narrative section.

DRAINAGE CURVES

To determine the required runoff and design capacity for the drainageways, the Cypress Creek formula was used:

$$Q = CM^{5/6}$$

Where: Q = Average rate of runoff in cubic feet per second for which the ditch is to be designed.

C = Appropriate drainage coefficient for 1 square mile of watershed.

M = Square miles of watershed.

This formula provides an economical and effective design for open ditches if C is selected properly.

The drainage coefficient is the rate of removal of runoff to provide a specific degree of drainage protection to an area. Land use, soils, topography and rainfall intensities and duration determine the selection of drainage coefficients.

Three runoff curves have been developed from which required drainage capacities of open ditches in this report were computed. Each curve is based on a particular land use. For purposes of this report, curves selected were for present land use. (See Figure No. 1)

The highest curve used is for general crops followed in descending order by the curve for pasture or grassland and the curve for forest or woodland.

These curves provide for the removal, in 24 hours, of the following estimated amounts of runoff for a one square mile area.

General crops curve	-	1.67 inches
Pasture Curve	-	.93 inches
Woodland Curve	-	.37 inches

VELOCITY

The maximum safe velocity in an open channel is determined based on soil characteristics, the shape of the channel, and available means

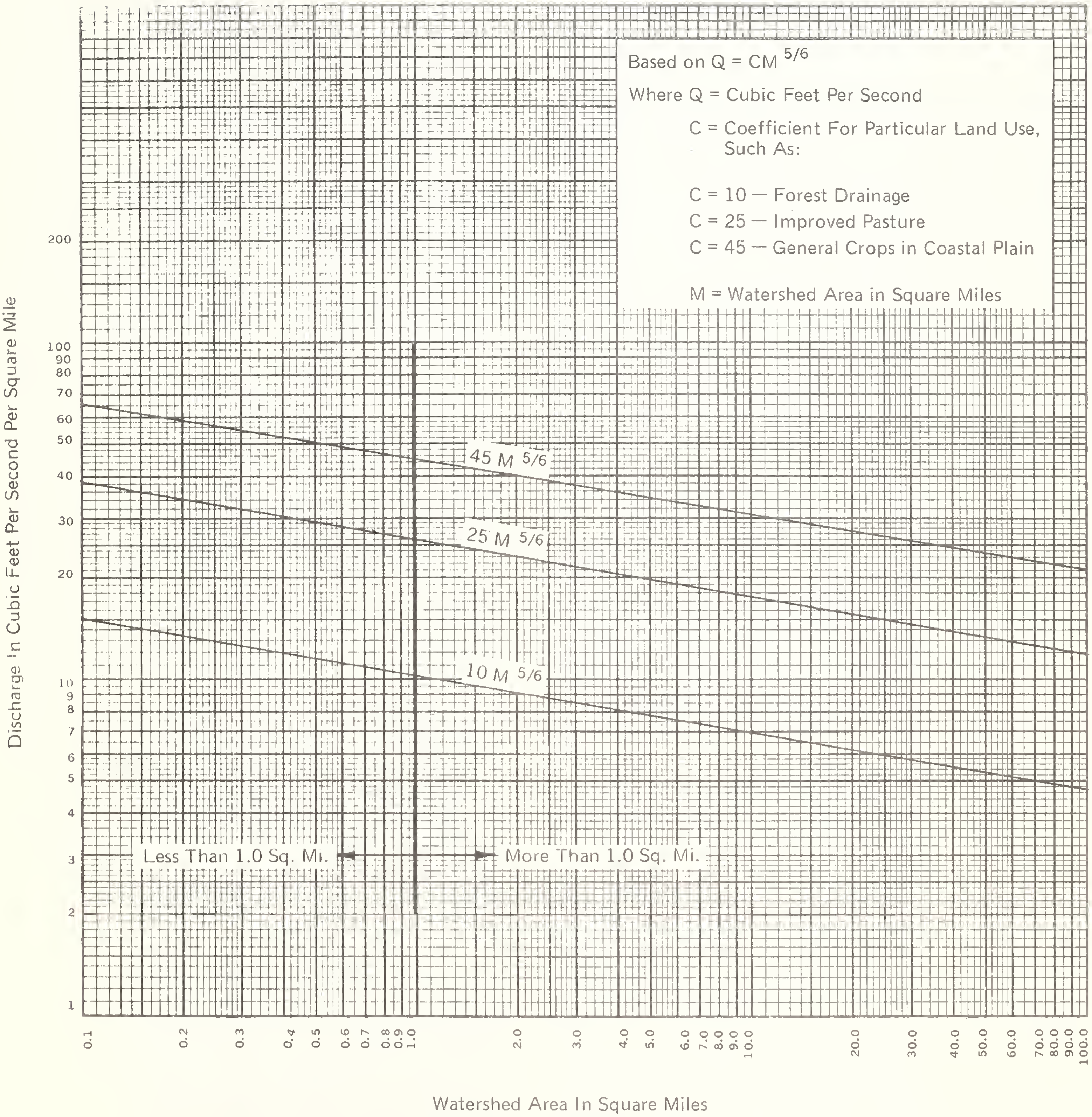


Figure No. 1 — Drainage Coefficient Curves

for the stabilization of the channel after construction. The optimum velocity for channels, based on soil conditions in Georgetown County, is approximately 2 feet per second. The soils are predominantly sands. There are numerous areas where fine sands occur, therefore the design of channels in these lighter soils must consider the need for checking erosion and bank sloughing that might occur, immediately following construction, when water tables are high.

Velocities were computed by use of Manning's formula:

$$V = \frac{1.486}{n} \times r^{2/3} \times s^{1/2}$$

Where: n = roughness coefficient
r = hydraulic radius
s = slope in feet per foot along the ditch

The proper design of a ditch cross section requires the selection of the proper value of "n". The following tabulations were used for selection of these values in the design of main canals with good alignment:

Hydraulic Radius*	"n"
Less than 2.5	.045
2.5 to 4.0	.040
4.0 to 5.0	.035
Over 5.0	.030

*The hydraulic radius is obtained by dividing the proposed area of the channel cross section by its wetted perimeter.

Roughness coefficients were selected anticipating flow retardance features, vegetative growth and sedimentation, several years after construction. Newly dug channels with lower roughness coefficients will have higher velocities initially. These velocities will reduce as the vegetation and sedimentation occur, especially during the first few years.

CHANNEL CROSS SECTION

Depth and width of the channel are both significant considerations in design. Channels designed for subsurface drainage must be deep enough to intercept at some depth below the surface and allow for safe disposal. The channel depth must be adequate for lateral ditches and tile drains. Other things considered to favor deeper channels with resulting narrower bottom widths are: less right-of-way is required, vegetative growth on the wetted perimeter is reduced, and conditions are less favorable for the formation of sandbars. A channel approximately as deep as its bottom width - within practical and economical limits - will remain effective for a longer period because it has more favorable hydraulic characteristics.

A minimum bottom width of 3.0 feet was used in sizing main channels, for this report. This conforms to a bucket width of small dragline excavating equipment commonly available in the county. Bottom widths were selected as narrow as design and construction criteria would permit to maintain a favorable hydraulic section with higher velocity to help prevent siltation.

Side slopes of the ditch, as well as depth and allowable velocities, are determined primarily by topography soil conditions, proposed maintenance methods, and a need for adequate rights-of-way. To satisfy these conditions, 1 to 1 side slopes were used for main channels in this report. Detailed soil surveys may indicate subsoils

that would allow ½ to 1 side slopes in some areas. This side slope has been used satisfactorily in some cases in the county. In urban areas, flatter side slopes may be desirable for aesthetic and easier maintenance purposes.

In fine sands, or other unstable soils, having high water tables, sloughing of side slopes may be expected immediately after excavation. Sloughing will continue until the water table becomes established at the lower level. The problem can be controlled somewhat in wide channels by utilizing a pilot channel to lower the water table, followed by final construction when the slopes have become more stabilized. If a pilot channel is not used, a maintenance operation may be required soon after the water table has stabilized to restore the desired cross section.

CULVERTS AND BRIDGES

Culverts generally restrict the flow of water in ditches by decreasing the flow area thereby causing a loss in hydraulic head. This was considered in sizing main channels. At culverts, during design flow, the hydraulic gradient was set low enough to keep the profile of the water surface well within the channel cross section in all critical areas.

RIGHT-OF-WAY REQUIREMENT-SPOIL BANK MANAGEMENT

Factors governing width of rights-of-way can best be understood by consulting Figure No. 2. The principal requirements for spoil bank management includes a right-of-way wide enough for placement of spoil and debris and shaping of spoil into a travelway for maintenance equipment. No berm widths are needed where the spoil is to be spread and shaped to establish a travelway on top of it. A berm width of 15 feet is recommended for access and to avoid slope failure where spoil is to be stacked and not shaped.

DESCRIPTION OF AREAS

To facilitate planning, the county was divided into 9 areas, generally along watershed divides or large drainageways. This delineation allowed the study to be made of the present drainage system and its needs peculiar to each area. A brief description of each area and the features having some influence on the study of its drainage problems follows:

AREA 1 - Outland - Rhems - Choppee

Located in the northern corner of Georgetown County, Area 1 is bounded on the north by the Great Pee Dee River, on the west by Williamsburg County and secondary road No. 5, on the south by Mingo Creek and Black River and on the east by the cross country water supply canal of International Paper Company.

This area is generally flat to slightly rolling and encompasses the highest elevation lands in the county - to approximately 65' above sea level. The rivers generally provide good drainage outlets for most of the area.

The soils are rather sandy but productive and include Norfolk, Goldsboro, Lakeland, Bladen and Craven. A large portion of this section contains farms that produce crops of tobacco, corn, soybeans and some truck crops. Along with the rest of the county, there is also much land in woodland. Wildlife in this area includes deer, raccoons, rabbits, squirrels, doves

and some quail.

An engineering feat, the water supply canal mentioned above brings water through open channel from the Great Pee Dee River, over 26 miles cross-country, to the International Paper Company at Georgetown. To cross the Black River near Oatland (Area 3) water is piped under the river and pumped back into open channel again to flow on to the plant.

AREA 2 - Yauhannah - Plantersville

A large portion of this area is rather wet natured. Bounded on the north and east by the Great Pee Dee River and on the west by the water supply canal (Internation Paper Company) and Carvers Bay. Also included is Tupelo Bay. All of these affect drainage on large acreages of land which are mainly devoted to timberland production. A small amount of farming is restricted to the higher better soil sections which like Area 1 produce corn, tobacco, soybeans, and some truck crops. The southern corner of this area along the Great Pee Dee River is lined by a number of old plantations most of which in colonial days produced rice and indigo. These plantations now are largely maintained as hunting preserves. Wildlife abounding in this area includes deer, raccoons, rabbits, squirrels, waterfowl and doves.

AREA 3 - Oatland - Hopewell Church Browns Ferry Bridge

Area 3, along the western side of Georgetown County joins Williamsburg County and is bounded on the northeast by Black River and Mingo Creek and on the southwest by Black River, with this river also meandering through its center. The river flood plain therefore affects the drainage in a major portion of the area. The main interest in this section of the county is timberland. The soils are light, sandy textured and restrict farming to the higher land, better soil locations, generally adjacent to highways through the area. Crops produced include corn, soybeans, tobacco and truck crops.

Plantations along the river are largely interested in wildlife - hunting and fishing.

AREA 4 - Campfield - Arundel Plantation - White House Plantation

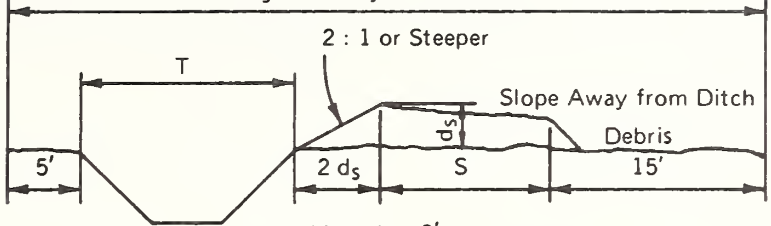
Located in the center of the county in the fork of Black River and the Great Pee Dee River, this area is largely in timberland. Plantations along the rivers are devoted largely to hunting and fishing. A small number of farms in the area produce corn, soybeans, tobacco and truck crops on the relatively flat fields located on the better productive soils.

The ditch designs shown in the tables are primarily for runoff removal based on a low coefficient for protection of timberland.

AREA 5 - Andrews - Sampit

Area 5, located in the western side of Georgetown County, is bordered by Williamsburg County on the west, Black River on the north and includes the town of Sampit and virtually all of the town of Andrews. Industrial and commercial interests are located around Andrews and along the Seaboard Coast Line Railroad that runs through this area.

Boggy Swamp on the southern side of the area and the Black River



TYPICAL CROSS SECTION — SPOIL SHAPED ONE SIDE

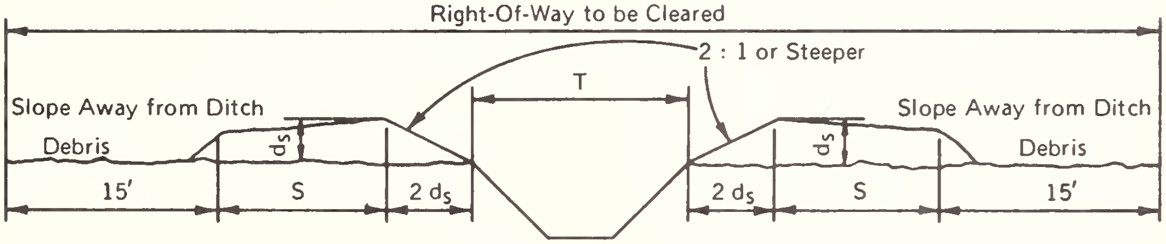
R.O.W. = 5 + T + 6 + S + 15

S = 1.3 A ÷ 3 (where A = Excavated Area)

Wooded Area - R.O.W. = $T + \frac{1.3\ A}{3} + 26$

Open Area - R.O.W. = $T + \frac{1.3\ A}{3} + 11$

Bottom Width Less than 20 ft.



TYPICAL CROSS SECTION — SPOIL SHAPED BOTH SIDES

R.O.W. = 15 + S + 6 + T + 6 + S + 15

R.O.W. = 2S + T + 42

2S = 1.3 A ÷ 6 (where A = Excavated Area)

Wooded Area - R.O.W. = $T + \frac{1.3\ A}{6} + 42$

Open Area - R.O.W. = $T + \frac{1.3\ A}{6} + 22$

Bottom Width More Than 20 ft.

FIGURE 2

Swamp on the northern side affect drainage on the major portion of the land. Limited farming interests produce the usual corn, soybeans, tobacco, and truck crops but is restricted to the higher better soil areas between the major swamps. Woodland occupies most of the remaining land with wildlife generally widespread. It is largely owned by commercial timberland companies.

AREA 6 - Georgetown - Johnsons Chapel - Beneventum Plantation

This area, located in the center of the county, is bounded by Black River on the north and east, Gapway Bay on the west and Sampit River on its southern border. The town of Georgetown with its sprawling residential sections, commercial interests, and industrial plants comprises a large part of Area 6 and is noted as an early colonial port city. The larger industries include International Paper Company, Georgetown Steel Corporation, and American Cyanamid Company. A number of other plants are located near the town. Georgetown is also known for its fishing and shrimp interests.

Immediately north of the town, along Black River, are a number of old plantations devoted mainly to hunting and fishing. The rest of the area is occupied by large tracts of timberland owned by commercial interests. Gapway Bay along the western side affects the drainage of that flat section. The tables show designs based on timberland protection.

AREA 7 - Murrels Inlet - Pawleys Island - Hobcaw Plantation

Area 7 is bounded on the west by Waccamaw River, on the south by Winyah Bay, and its eastern shore runs along the Atlantic Ocean. The southern half is comprised of a large acreage of mud flats and marsh and several plantations with old rice fields along the Waccamaw River on the western side. It is virtually all flat, sandy and wooded. The northern half of this area has plantations along the banks of Waccamaw River. The Waccamaw River is used as a connecting link for the Intracoastal Waterway from Horry County to Winyah Bay at Georgetown.

The northern section of Area 7 coastal beach includes Brookgreen Gardens that displays one of the finest collections of statuary in the world, placed in garden settings. There are several fine beaches along the ocean front which is considered a part of the Grand Strand of South Carolina. It extends along the coast through Horry County to the North Carolina state line and is an intensely developed vacation and recreation beach area. Over three dozen golf courses are located in the 35 mile long Grand Strand Area, in addition to hundreds of other recreation facilities and tourist attractions- an extensive vacation land.

AREA 8 - Cedar Creek - Canon Bay - Little Kilsock Bay

This area, in the southwest corner of Georgetown County, joins Williamsburg County on the west, is bordered on the south by Santee River and Little Kilsock Bay on the east.

The area is relatively flat and the drainage runoff is influenced by the bays and wide river flood plains. It is largely covered with woodland and timber producing areas owned by commercial timber

companies. A few small farms are scattered over this area primarily along the highways. Farming is restricted to general crops on a small scale on sandy soils.

The ditch designs shown in the tables for this area are for the drainage protection of extensive timberland and based on a low coefficient of runoff removal.

AREA 9 - Maryville - Big Kilsock Bay - North Santee - Annandale Plantation

Area 9, located in the southeastern corner of Georgetown County is bordered by Winyah Bay and the Sampit River on the north, the Atlantic Ocean on the east, the Santee River on the south and Kilsock Bay on the west.

The southern half of the area is composed of several islands covered largely with tidal marshes. Several old plantations are located on the northern edge of these islands and include a large area of old rice fields. The area north of state road No. 30 consists of timberland owned by timber companies. Belle Isle Gardens is included in the section joining Winyah Bay, immediately south of Maryville. Maryville is part of the industrial, commercial, and residential segment of Georgetown metropolitan area that lies south of the Sampit River.

Kilsock Bay on the western border of this area influences drainage over a large number of acres of woodland. Ditch designs shown in the table for this area are, as in Area 8, for the drainage protection of extensive timberland and based on a low runoff coefficient of runoff.

Wildlife in Area 9 is plentiful and includes deer, raccoons, rabbits, squirrel, wild turkeys, waterfowl, and alligators on some of the islands. The coastal sections of some of these islands and some of the barrier islands in Area 7 are unique in being the nesting grounds for the green sea turtle, an endangered species.

FACTORS CONSIDERED IN PREPARATION OF PLAN

The Water Runoff Study was prepared by engineers of the Soil Conservation Service with the assistance of the Georgetown County Commissioners. On-site investigations were made of the outlets for each main canal, and the factors affecting water disposal within the watershed, such as land use, river stages, flooding, and the time of year in which flooding occurs, were studied.

Present land use and anticipated future land use was considered in sizing the drainage ditches for this study. Engineering information available through the Georgetown Field Office of the Soil Conservation Service was also used, particularly that pertaining to drainage investigations.

U. S. Geological Survey Topographic Maps were used in many areas to determine the general topography within each watershed and to assist in delineation of watersheds. A limited amount of instrument surveying was done in some areas to determine direction of runoff and outlets.

Aerial photographs, scale 1" = 1320', flown in 1968, were used in recording field data and for the preparation of the drainage plan.

Agencies and commercial concerns, having knowledge of specific

drainage problems, were consulted in making decisions in certain areas. Also, maps, surveys and plans available from these agencies were used.

In most instances, mains were located along natural drains with modifications in alignment to improve the flow and collection of water. All needed laterals within the watersheds were not located since the purpose of the study is to locate and size only the main canals which will furnish a means of disposal of runoff from all parts of the watershed. All mains terminate in rivers, creeks or natural outlets at a point where they have adequate capacity and depth.

No attempt was made to locate underground utilities, such as telephone cables, gas pipelines, water mains, and conduits, as a part of this study. However, due consideration must be given to the location of these underground utilities during the preparation of the final plans.

Watersheds draining into the county from adjoining counties were included in the design of main canals. The mains, however, are shown beginning at the county line. Attention was given to possible land use changes in adjacent counties that would affect runoff coming into these watersheds.

ENGINEERING CONSIDERATIONS

Engineering considerations for planning, design, construction, maintenance and other items pertinent to the main drainageways and outlets for the Water Runoff Study are listed below:

DESIGN

This Water Runoff Study was made to estimate the extent of needed main disposal outlets and the physical practicability of drainage in the county. Detailed engineering surveys and designs will be required before any part of the proposed plan can be constructed. All improvements should be made continuous. Layout and construction should begin at the outlet end and continue upstream.

Plans and designs contained in this report do not include a complete study of underground storm sewers near towns found in Areas 5, 6, 7, and 9. Sufficient engineering data was not available on the sewers in these areas to include in this report. Detailed studies will be needed to determine the adequacy of these storm sewers and any additional needs or modifications.

No attempt was made in this study to size culverts. Culverts at railroad and road crossings should be designed to satisfy the minimum requirements based on expected flow. Increases in size of these structures may be desirable to provide an added safety factor for passing runoff in excess of designed flow where future unforeseen improvements are to be made in the vicinity.

The South Carolina Wildlife and Marine Resources Department, The South Carolina Coastal Council, and other organizations or agencies concerned with environmental protection should be consulted when the ecology of an area may be affected by the construction of main drainage canals.

As previously mentioned under the topic of WILDLIFE, the Federal Water Pollution Control Act Amendment of 1972, Section 404, regulates the placing of fill material in coastal

and inland waters and wetlands. Before undertaking any construct-ion in water or wetland areas an application for a Section 404 permit should be made to the nearest district office of the U. S. Army Corps of Engineers.

ACQUISITION OF RIGHTS-OF-WAY

The means for, and the acquisit-ion of, adequate rights-of-way for the installation of main canals is absolutely essential. The right-of-way must be adequate to meet the width requirements for the channel section, berm, spoil management, and to assure access.

MAINTENANCE OF CHANNELS

A well-organized and adequately financed maintenance program is essential for proper maintenance of channels.

Provision for annual maintenance or periodic reconstruction to maintain the effectiveness of the channel must be considered prior to design. Many water disposal projects fail to function as designed and this can be directly attributed to an inadequate maintenance program. Maintenance of designed depth of channels is one of the most important items in a maintenance program. The cost of maintenance may be reduced considerably if provision is made in channel designs for easy access and stabilization of silt-contributing areas, such as ditch side slopes, new road fills and road ditch intersections, immediately following construct-ion.

OBSTRUCTIONS

Construction of fences, walks and other structures that may retard channel flow should not be permitted. Other structures such as culverts, bridge piers, trestles, etc., should be designed to result in minimum interference with the channel flow. Dumping trash, garbage and other debris in channels should be prohibited.

DEFINITION OF TERMS

Brief descriptions of terms used in this report are listed below in alphabetical order.

c.f.s. - Abbreviation for cubic feet per second; a unit of waterflow sometimes called "second feet."

Infiltration - The entrance of water into surface horizons of soil.

Internal Drainage - The movement of water through the soil profile. The rate is affected by the texture of the surface soil and of the subsoil and by the height of the water table. A wet, deep sand may have slow internal drainage when the water table is high, and rapid internal drainage when the water table is low. A plastic, sandy clay soil may have slow internal drainage regardless of water table height.

Lateral Ditch - A major ditch in a drainage system which serves as a link between the main ditch and the collection system in a segment of the watershed.

Main Canal (Ditch or Channel) - The principal channel which conducts the drainage water from the watershed to the outlet.

Permeability Rate - The rate of movement of water through the soil.

Profile, Soil - A vertical section of the soil through all its horizons and extending into the parent material.

Reach - A length of channel selected for use in hydraulic computations.

Relief - The elevations or inequalities of a land surface, considered collectively.

Runoff, Surface - The total rainfall minus losses from interception, infiltration, evapotranspiration, and surface storage; that which moves across the ground to a stream or depression.

Runoff, Subsurface - Water that infiltrates the soil and reappears as seepage or spring flow.

Soil Drainage - (1) The rapidity and extent of the removal of water from the soil by runoff and flow through the soil to underground spaces. (2) As a condition of the soil, the frequency and duration of periods when the soil is free of saturation. For example, in well-drained soils, the water is removed readily, but not rapidly; in poorly drained soils, the root zone is waterlogged for long periods and the roots of ordinary crop plants cannot get enough oxygen; and in excessively drained soils, the water is removed so completely that most crop plants are damaged by lack of water.

Soil Structure - The arrangement of the individual grains and aggregates that make up the soil mass; may refer to the natural arrangements of the soil when in place and undisturbed or to the soil at any degree of disturbance.

Subsoil - In soils with weak profile development, the subsoil can be defined as the soil below the plowed soil (or its equivalent of surface soil) in which roots normally grow.

Surface Soil - The soil ordinarily moved in tillage or the equivalent in uncultivated soil about six to ten inches in thickness.

Terrace (Geological) - An old alluvial plain, ordinarily flat or undulating, bordering a river, lake or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, Soil - The relative proportions of sand, silt and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles are as follows: sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine." A coarse-textured soil is one high in sand content; a fine-textured soil is one high in clay content.

Water-holding Capacity - The ability of a soil to hold water. The capacity (or ability) of soil to hold water against gravity.

Watershed - An area of land from which all water that falls within the area converges toward and discharges past a designated point.

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WATER RUNOFF STUDY FOR MAIN DRAINAGEWAYS AND OUTLETS in Florence County.

WATER MANAGEMENT STUDY FOR MAIN DRAINAGE CANALS in Dorchester County.

FEASIBILITY STUDY FOR MAIN DRAINAGE CANALS in Horry County.

AUTHORITY AND ACKNOWLEDGEMENT

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Georgetown County Commissioners -

Alfred Schooler
Edsil Hemingway
Dr. C. J. Beck
Leon Bellamy
J. D. Munnerlyn

Georgetown Drainage Commission -

P. C. McClary
J. D. Munnerlyn
John W. Harrelson
Floyd B. Miller
Edsil Hemingway

Georgetown Soil and Water Conservation District Commissioners -

P. C. McClary
B. M. Chandler
A. M. Flowers
J. D. Munnerlyn
Dock Pope

Soil Conservation Service - George E. Huey, State Conservationist

Administrative supervision for the Soil Conservation Service -

O. S. Kirkpatrick - former Area Conservationist
B. Clayton Graham - former Area Conservationist
John S. Case - Area Conservationist

Direct responsibility for preparation of plans, designs and final report:

Calvin B. Derrick - Civil Engineer, Soil Conservation Service
Henry B. Watson - Soil Conservation Technician,
Soil Conservation Service
Harry E. Grant - Soil Conservation Technician,
Soil Conservation Service
Charles W. Harrington - Soil Conservation Technician,
Soil Conservation Service
Henry P. Moore, Jr. - Soil Conservation Technician,
Soil Conservation Service

Special technical assistance during all phases of the preparation of the report was given by:

S. Taylor Currin, former State Conservation Engineer,
Soil Conservation Service
W. Burton Wells, State Conservation Engineer,
Soil Conservation Service
Benjamin N. Stuckey, Jr., Soil Scientist,
Soil Conservation Service

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EXPLANATION OF ENGINEERING DATA TABLES

The following Engineering Data Tables contain information, listed by areas, for each main canal and lateral watershed.

An explanation of each column in the Engineering Data Sheets is as follows:

Column 1 CANAL NUMBER
Numbering of main canals begin with M-1 and laterals with L-1, in each area.

Column 2 LENGTH IN FEET
Stationing of all mains and laterals begins at the upper end (headwaters) and continues toward the outlet. Mains and laterals are shown in reaches or sections in the data tables for design purposes. Each reach or section reflects a change in water concentration resulting from entrance of lateral drainage.

Column 3 WATERSHED IN ACRES
See definition of terms.

Column 4 DISCHARGE-CUBIC FEET PER SECOND
From appropriate drainage coefficient curves dependent on land use. (See Fig. No. 1)

Column 5a TOP WIDTH IN FEET
All ditches estimated on average 5' depth.

Column 5b BOTTOM WIDTH IN FEET
Self-explanatory.

Column 6 EXCAVATION IN CUBIC YARDS
Self-explanatory.

Column 7 RIGHT-OF-WAY CLEARING IN ACRES
Self-explanatory.

Column 8 REQUIRED RIGHT-OF-WAY WIDTH IN FEET
Minimum width requirements for channel cross section, spoil management, berm width and maintenance access road.

SUMMARY OF ENGINEERING AND DESIGN DATA BY AREAS

AREA NUMBER	LENGTH OF CANALS Feet	EXCAVATION Cubic Yds.	RIGHT-OF-WAY CLEARING Acres
1	346,900	553,869	267.3
2	252,200	373,120	185.9
3	118,900	199,523	94.6
4	217,600	306,907	153.3
5	48,600	75,223	33.2
6	257,500	358,737	186.4
7	83,200	123,149	61.3
8	111,400	171,212	83.5
9	76,200	113,061	55.9
COUNTY TOTALS	1,512,500	2,274,801	1121.4

ENGINEERING AND DESIGN DATA

Area 1 - Outland - Rhems - Choppee

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-1A	5900	588	42	13	3	8737	4.3	60
M-1B	2600	736	45	14	4	4342	2.1	60
Total-1	8500					13,079	6.4	
M-2A	4800	488	36	13	3	7104	3.5	60
M-2B	4800	1328	83	17	7	10656	4.7	60
L-1	6600	276	22	13	3	9768	4.8	60
M-2C	1700	1660	98	19	9	4403	1.9	60
M-2D	1200	1692	101	19	9	3108	1.3	60
Total-2	19,100					35,039	16.2	
M-3A	4600	416	7	13	3	6808	3.4	60
M-3B	2000	704	30	13	3	2960	1.5	60
M-3C	1500	760	34	13	3	2220	1.1	60
M-3D	800	768	35	13	3	1184	0.6	60
Total-3	8900					13,172	6.6	
M-4A	4800	292	23	13	3	7104	3.5	60
L-1A	5300	476	35	13	3	7844	3.9	60
L-1B	1200	524	38	13	3	1776	0.9	60
M-4B	3400	964	63	17	7	7548	3.4	60
L-2A	7900	540	Present canal with proper maintenance will be adequate					
L-2B	2600	652	46	14	4	4342	2.1	60
M-4C	1500	1664	100	19	9	3885	1.7	60
Total-4	22,700					32,499	15.5	

ENGINEERING AND DESIGN DATA
Area 1 - Outland - Rhems - Choppee

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-5A	4000	628	44	13	3	5920	2.9	60
M-5B	4000	868	58	14	4	6680	3.2	60
Total-5	8000					12,600	6.1	
M-6	3700	600	42	13	3	5476	2.7	60
Total-6	3700					5476	2.7	
M-7A	5900	504	37	13	3	8732	4.3	60
M-7B	900	620	44	14	4	1503	0.7	60
L-1	4800	444	33	13	3	7104	3.5	60
M-7C	1800	1396	86	18	8	4338	1.9	60
M-7D	2500	1684	101	19	9	6475	2.8	60
M-7E	5500	2288	129	22	12	17325	7.1	65
Total-7	21,400					45,477	20.3	
M-8A	7100	464	34	13	3	10508	5.2	60
M-8B	1800	528	38	13	3	2664	1.3	60
Total-8	8900					13,172	6.5	
M-9A	1600	392	30	13	3	2368	1.2	60
M-9B	1300	436	33	13	3	1924	1.0	60
Total-9	2900					4292	2.2	

ENGINEERING AND DESIGN DATA

Area 1 - Outland - Rhems - Choppee

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-10	2600	2292	130	19	9	6734	2.9	60
Total-10	2600					6734	2.9	
M-11A	3200	300	24	13	3	4736	2.4	60
M-11B	2200	424	32	13	3	3256	1.6	60
Total-11	5400					7992	4.0	
M-12A	800	80	7	13	3	1184	0.6	60
M-12B	1200	184	16	13	3	1776	0.9	60
M-12C	2600	324	25	13	3	3848	1.9	60
M-12D	2800	572	41	13	3	4144	2.0	60
M-12E	3700	776	53	13	3	5476	2.7	60
Total-12	11,100					16,428	8.1	
M-13A	2500	176	15	13	3	3700	1.8	60
M-13B	2000	460	34	13	3	2960	1.5	60
M-13C	3400	648	45	13	3	5032	2.5	60
Total-13	7900					11,692	5.8	
M-14A	4500	332	6	13	3	6660	3.3	60
M-14B	2800	692	34	13	3	4144	2.1	60
M-14C	7800	1200	64	16	6	15912	7.2	60
M-14D	3300	1580	84	17	7	7326	3.3	60
Total-14	18,400					34,042	15.9	

ENGINEERING AND DESIGN DATA

Area 1 - Outland - Rhems - Choppee

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-15A	6100	640	45	14	4	10187	4.9	60
M-15B	2800	812	55	15	5	5180	2.4	60
L-1A	1800	128	12	13	3	2664	1.3	60
L-1B	3200	260	21	13	3	4736	2.4	60
M-15C	2800	1488	90	16	6	5712	2.6	60
M-15D	1000	1784	106	17	7	2220	1.0	60
M-15E	3300	1904	111	18	8	7953	3.5	60
Total-15	21,000					38,652	18.1	
M-16	10600	600	43	13	3	15688	7.8	60
Total-16	10,600					15,688	7.8	
M-17A	4000	364	6	13	3	5920	2.9	60
M-17B	5100	912	13	13	3	7548	3.7	60
M-17C	6900	1524	21	13	3	10212	5.1	60
M-17D	5200	1852	46	13	3	7696	3.8	60
Total-17	21,200					31,376	15.5	
M-18A	6300	496	8	13	3	9324	4.6	60
M-18B	3300	648	10	13	3	4884	2.4	60
Total-18	9600					14,208	7.0	

ENGINEERING AND DESIGN DATA
Area 1 - Outland - Rhems - Choppee

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-19A	6100	580	9	13	3	9028	4.5	60
M-19B	4000	716	20	13	3	5920	2.9	60
M-19C	1300	732	21	13	3	1924	1.0	60
Total-19	11,400					16,872	8.4	
M-20	3400	816	55	14	4	5678	2.5	60
Total-20	3400					5678	2.5	
M-21A	5900	340	6	13	3	8732	4.3	60
M-21B	1100	368	6	13	3	1628	0.8	60
L-1A	1600	128	3	13	3	2368	1.2	60
L-1B	6300	384	4	13	3	9324	4.6	60
M-21C	3800	1084	13	13	3	5624	2.8	60
M-21D	2200	1136	18	13	3	3256	1.6	60
Total-21	20,900					30,932	15.3	
M-22A	4900	488	8	13	3	7252	3.6	60
M-22B	3800	668	10	13	3	5624	2.8	60
Total-22	8700					12,876	6.4	
M-23A	8400	340	6	13	3	12432	6.2	60
M-23B	7300	748	12	13	3	10804	5.4	60
M-23C	4400	900	13	13	3	6512	3.2	60
Total-23	20,100					29,748	14.8	

ENGINEERING AND DESIGN DATA

Area 1 - Outland - Rhems - Choppee

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-24	5300	412	7	13	3	7844	3.9	60
Total-24	5300					7844	3.9	
M-25	15800	2824	35	13	3	23384	11.6	60
Total-25	15,800					23,384	11.6	
M-26A	3000	208	4	13	3	4440	2.2	60
L-1	7000	680	11	13	3	10360	5.1	60
M-26B	4000	1008	15	13	3	5920	2.9	60
L-2	10000	836	13	13	3	14800	7.3	60
M-26C	3900	1948	26	13	3	5772	2.9	60
L-3	12000	1080	16	13	3	17760	8.8	60
M-26D	9500	3788	45	14	4	15865	7.6	60
Total-26	49,400					74,917	36.8	

ENGINEERING AND DESIGN DATA
Area 2 - Yauhanna - Plantersville

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-1A	1300	120	11	13	3	1924	1.0	60
M-1B	3300	150	22	13	3	4884	2.4	60
L-1A	2000	100	10	13	3	2960	1.5	60
L-1B	2500	80	16	13	3	3700	1.8	60
M-1C	3000	Present canal with proper maintenance will be adequate						
Total-1	9100					13,468	6.7	
M-2A	1300	50	5	13	3	1924	1.0	60
M-2B	3100	410	31	13	3	4588	2.3	60
M-2C	4000	650	45	13	3	5920	2.9	60
L-1A	4700	440	33	13	3	6956	3.5	60
L-1B	1600	600	43	13	3	2368	1.2	60
L-1C	2500	770	52	13	3	3700	1.8	60
M-2D	3100	Present canal with proper maintenance will be adequate						
Total-2	17,200					25,456	12.7	
M-3A	1300	170	15	13	3	1924	1.0	60
M-3B	600	180	16	13	3	888	0.4	60
L-1A	2600	120	10	13	3	3848	1.9	60
L-1B	600	130	11	13	3	888	0.4	60
M-3C	2600	Present canal with proper maintenance will be adequate						
Total-3	5100					7548	3.7	

ENGINEERING AND DESIGN DATA

Area 2 - Yauhanna - Plantersville

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-4A	4000	340	6	13	3	5920	2.9	60
M-4B	2100	510	8	13	3	3108	1.5	60
M-4C	1300	550	9	13	3	1924	1.0	60
L-1A	2300	120	3	13	3	3404	1.7	60
L-1B	1200	140	3	13	3	1776	0.9	60
M-4D	4600	950	14	13	3	6808	3.4	60
Total-4	15,500					22,940	11.4	
M-5A	3300	120	2	13	3	4884	2.4	60
L-1A	7200	680	10	13	3	10656	5.3	60
L-1B	4000	860	13	13	3	5920	2.9	60
M-5B	4700	1440	20	13	3	6956	3.5	60
L-2	8500	550	9	13	3	12580	6.2	60
M-5C	4500	2590	33	13	3	6660	3.3	60
L-3	4800	350	6	13	3	7104	3.5	60
M-5D	2500	3140	38	13	3	3700	1.8	60
Total-5	39,500					58,460	28.9	
M-6A	5800	400	7	13	3	8584	4.3	60
M-6B	1900	520	8	13	3	2812	1.4	60
M-6C	2300	640	10	13	3	3604	1.7	60
Total-6	10,000					15,000	7.4	

ENGINEERING AND DESIGN DATA
Area 2 - Yauhanna - Plantersville

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-7A	1500	60	6	13	3	2220	1.1	60
M-7B	2100	120	10	13	3	3108	1.5	60
L-1A	1500	40	4	13	3	2220	1.1	60
L-1B	1800	70	15	13	3	2664	1.3	60
M-7C	1000	220	17	13	3	1480	0.7	60
L-2	Present canal with proper maintenance will be adequate							
M-7D	1300	290	22	13	3	1924	1.0	60
Total-7	9200					13,616	6.7	
M-8A	1300	60	6	13	3	1924	1.0	60
M-8B	2700	160	14	13	3	3996	2.0	60
L-1A	1300	40	4	13	3	1924	1.0	60
L-1B	3500	140	23	13	3	5180	2.6	60
M-8C	1300	330	26	13	3	1924	1.0	60
Total-8	10,100					14,948	7.6	
M-9A	3300	210	4	13	3	4884	2.4	60
M-9B	3300	570	9	13	3	4884	2.4	60
M-9C	3000	790	12	13	3	4440	2.2	60
L-1A	1900	80	8	13	3	2812	1.4	60
L-1B	1600	130	12	13	3	2664	1.2	60
M-9D	Present canal with proper maintenance will be adequate							
L-2A	600	40	4	13	3	888	0.4	60
L-2B	1300	70	7	13	3	1924	1.0	60
M-9E	Present canal with proper maintenance will be adequate							
L-3A	800	40	4	13	3	1144	0.6	60
Total-9	15,800					23,640	11.6	

ENGINEERING AND DESIGN DATA
Area 2 - Yauhanna - Plantersville

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-10A	5600	340	6	13	3	8288	4.1	60
M-10B	1300	360	7	13	3	1924	1.0	60
Total-10	6900					10,212	5.1	
M-11A	4000	400	30	13	3	5920	2.9	60
M-11B	800	490	36	13	3	1184	0.6	60
M-11C	8000	890	59	13	3	11840	5.9	60
Total-11	12,800					18,944	9.4	
M-12A	1900	100	9	13	3	2812	1.4	60
M-12B	3000	180	15	13	3	4440	2.2	60
L-1A	2700	140	13	13	3	3996	2.0	60
L-1B	1900	180	15	13	3	2812	1.4	60
M-12C	3600	530	38	13	3	5328	2.6	60
Total-12	13,100					19,388	9.6	
M-13A	6600	660	10	13	3	9768	4.8	60
M-13B	3800	960	14	13	3	5624	2.8	60
Total-13	10,400					15,392	7.6	
M-14A	4000	160	3	13	3	888	2.9	60
M-14B	4700	480	8	13	3	6956	3.5	60
M-14C	600	500	8	13	3	5920	0.4	60
Total-14	9300					13,764	6.8	

ENGINEERING AND DESIGN DATA

Area 2 - Yauhanna - Plantersville

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-15A	Present canal with proper maintenance will be adequate							
L-1	Present canal with proper maintenance will be adequate							
M-15B	Present canal with proper maintenance will be adequate							
M-15C	5200	900	13	13	3	7696	4.6	60
L-2A	1900	160	3	13	3	2812	1.4	60
L-2B	6200	580	9	13	3	9176	4.6	60
L-2C	3300	720	11	13	3	4884	2.4	60
M-15D	2100	1790	23	13	3	3108	1.5	60
L-3A	4600	170	3	13	3	6808	3.4	60
L-4	3800	300	5	13	3	5624	2.8	60
L-3B	8600	1030	15	13	3	12728	6.3	60
M-15E	3300	3070	37	13	3	4884	2.4	60
Total-15	39,000					57,720	29.4	
M-16A	4500	280	22	13	3	6660	3.3	60
M-16B	3300	460	34	13	3	4884	2.4	60
M-16C	3900	640	45	13	3	5180	2.9	60
Total-16	11,700					16,724	8.6	
M-17A	3800	220	18	13	3	5624	2.8	60
M-17B	1800	270	21	13	3	2664	1.3	60
Total-17	5600					8288	4.1	
M-18A	4000	80	8	13	3	5920	2.9	60
M-18B	2600	130	11	13	3	3848	1.8	60
Total-18	6600					9768	4.7	

ENGINEERING AND DESIGN DATA

Area 2 - Yauhanna - Plantersville

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-19A	1900	90	7	13	3	2812	1.4	60
M-19B	3400	270	22	13	3	5032	2.5	60
Total-19	5300					7844	3.9	

ENGINEERING AND DESIGN DATA

Area 3 - Oatland - Hopewell Church - Browns Ferry Bridge

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-1A	5000	380	29	13	3	7400	3.7	60
L-1A	1700	420	32	13	3	2516	1.2	60
L-1B	4400	696	48	14	4	7348	3.5	60
M-1B	1200	1116	78	17	7	2664	1.2	60
M-1C	1300	1176	79	17	7	2886	1.3	60
L-2A	600	348	6	13	3	888	0.4	60
L-2B	2400	748	12	13	3	3552	1.8	60
L-2C	2000	828	13	13	3	2960	1.5	60
L-3A	5300	344	6	13	3	7844	3.9	60
L-3B	3600	564	9	13	3	5328	2.6	60
L-2D	1000	1428	20	13	3	1480	0.7	60
L-2E	4500	1844	25	13	3	6660	3.3	60
L-4A	5200	332	6	13	3	7696	3.8	60
L-4B	1800	608	10	13	3	2664	1.3	60
L-4C	4900	832	15	13	3	7252	3.6	60
L-2E	1200	2706	41	13	3	3780	0.9	60
M-1D	800	3910	121	22	12	2520	1.0	65
Total-1	46,900					75,438	35.7	

ENGINEERING AND DESIGN DATA

Area 3 - Oatland - Hopewell Church - Browns Ferry Bridge

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-2A	3500	508	9	13	3	5180	2.6	60
L-1A	2000	596	10	13	3	2960	1.5	60
L-1B	3300	920	14	13	3	4884	2.4	60
M-2B	5500	1672	12	13	3	8140	4.0	60
M-2C	4500	2296	29	13	3	6660	3.3	60
M-2D	1000	2332	30	13	3	1480	0.7	60
L-2A	2500	276	6	13	3	3700	1.8	60
L-2B	4500	536	9	13	3	6660	3.3	60
M-2E	3500	3272	39	13	3	5180	2.6	60
M-2F	4000	3704	72	13	3	8160	3.7	60
M-2G	3100	4084	102	19	9	8029	3.5	60
Total-2	37,400					61,033	29.4	
M-3A	5000	368	1	13	3	7400	3.7	60
M-3B	4700	704	11	13	3	6956	3.5	60
L-1A	3900	264	5	13	3	5772	2.9	60
M-3C	2900	1232	18	13	3	4292	2.1	60
L-2A	5900	548	40	13	3	8732	4.3	60
L-2B	5700	832	56	15	3	10545	5.0	60
M-3D	2000	2340	97	19	9	5180	2.2	60
M-3E	4500	2764	129	22	12	14175	5.8	75
Total-3	34,600					63,052	29.5	

ENGINEERING AND DESIGN DATA

Area 4 - Campfield - Arundel Plantation - White House Plantation

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-1A	2400	152	4	13	3	3552	1.8	60
L-1A	2200	96	Present canal with proper maintenance will be adequate					
L-1B	2100	136	Present canal with proper maintenance will be adequate					
M-1B	6300	796	12	13	3	9324	4.6	60
L-2	4500	148	3	13	3	6660	3.3	60
M-1C	1600	1056	16	13	3	2368	1.2	60
M-1D	2200	1120	Present canal with proper maintenance will be adequate					
L-3A	1700	96	3	13	3	2516	1.2	60
L-3B	3200	200	5	13	3	4736	2.4	60
M-1E	2000	1472	Present canal with proper maintenance will be adequate					
Total-1	28,200					29,156	14.5	
M-2A	1800	64	2	13	3	2664	1.3	60
M-2B	2500	168	4	13	3	3700	1.8	60
L-1A	1300	72	2	13	3	1924	1.0	60
L-1B	5700	312	6	13	3	8436	4.0	60
L-1C	2000	372	7	13	3	2960	1.5	60
M-2C	4600	960	15	13	3	6808	3.4	60
M-2D	2100	1112	16	13	3	3108	1.5	60
M-2E	2700	1276	18	13	3	3996	2.0	60
M-2F	2400	1484	20	13	3	3552	1.8	60
M-2G	3800	1672	23	13	3	5624	2.8	60
Total-2	28,900					42,772	21.1	

ENGINEERING AND DESIGN DATA

Area 4 - Campfield - Arundel Plantation - White House Plantation

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-3A	2300	152	4	13	3	3404	1.7	60
M-3B	5200	804	12	13	3	7696	3.8	60
Total-3	7500					11,100	5.5	
M-4A	1500	92	2	13	3	2220	1.1	60
M-4B	5400	432	8	13	3	7992	4.0	60
Total-4	6900					10,212	5.1	
M-5	8800	464	10	13	3	13024	6.5	60
Total-5	8800					13,024	6.5	
M-6	8800	664	11	13	3	13024	6.5	60
Total-6	8800					13,024	6.5	
M-7A	2000	152	4	13	3	2960	1.5	60
M-7B	1500	212	4	13	3	2220	1.1	60
L-1A	4600	224	5	13	3	6808	3.4	60
L-1B	1100	252	5	13	3	1628	0.8	60
M-7C	4000	676	11	13	3	5920	2.9	60
L-2A	1600	84	2	13	3	2368	1.2	60
L-2B	9400	492	9	13	3	13952	6.9	60
M-7D	1300	1332	19	13	3	1924	1.0	60
Total-7	25,500					37,780	18.8	

ENGINEERING AND DESIGN DATA

Area 4 - Campfield - Arundel Plantation - White House Plantation

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-8A	2700	100	3	13	3	3996	2.0	60
M-8B	3300	252	5	13	3	4884	2.4	60
M-8C	2800	348	6	13	3	4144	2.1	60
Total-8	8800					13,024	6.5	
M-9A	1800	96	3	13	3	2664	1.3	60
M-9B	4000	184	6	13	3	5920	2.4	60
Total-9	5800						3.7	
M-10	5900	340	6	13	3	8732	4.3	60
Total-10	5900					8732	4.3	
M-11A	4100	336	6	13	3	6068	3.0	60
M-11B	4200	612	9	13	3	6216	3.1	60
Total-11	8300					12,284	6.1	
M-12A	5700	356	7	13	3	8436	4.2	60
M-12B	2000	416	8	13	3	2960	1.5	60
Total-12	7700					11,396	5.7	

ENGINEERING AND DESIGN DATA

Area 4 - Campfield - Arundel Plantation - White House Plantation

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-13A	2700	316	6	13	3	3996	2.0	60
M-13B	3300	512	9	13	3	4884	2.4	60
M-13C	2500	596	10	13	3	3700	1.8	60
L-1A	2000	236	5	13	3	2960	1.5	60
L-1B	1700	284	6	13	3	2516	1.2	60
M-13D	2000	956	15	13	3	2960	1.5	60
M-13E	1500	984	15	13	3	2220	1.1	60
L-2A	3200	312	6	13	3	4736	2.4	60
L-2B	6300	620	10	13	3	9324	4.6	60
M-13F	1600	1636	23	13	3	2368	1.2	60
L-3A	2000	184	4	13	3	2960	1.5	60
L-3B	1200	228	5	13	3	1776	0.9	60
L-3C	2500	364	7	13	3	3700	1.8	60
M-13G	3600	2344	30	13	3	5328	2.6	60
Total-13	36,100					53,428	26.5	
M-14A	3500	232	5	13	3	5180	2.6	60
L-1	3900	228	5	13	3	5772	2.9	60
M-14B	3200	600	10	13	3	4763	2.4	60
Total-14	10,600					15,715	7.9	
M-15A	1300	88	2	13	3	1924	1.0	60
M-15B	2700	208	14	13	3	3996	2.0	60
L-1A	2700	128	3	13	3	3996	2.0	60
L-1B	4000	296	6	13	3	5920	2.9	60
M-15C	2600	600	30	13	3	3848	1.9	60
L-2A	800	140	4	13	3	1184	0.6	60
L-2B	3400	284	6	13	3	5032	2.5	60
M-15D	2300	1016	39	13	3	3404	1.7	60
Total-15	19,800					29,340	14.6	

ENGINEERING AND DESIGN DATA

Area 5 - Andrews - Sampit

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS		EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
				TOP WIDTH	BOTTOM WIDTH			
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-1A	2700	120	2	13	3	3996	2.0	60
M-1B	3500	360	6	13	3	5180	2.6	60
M-1C	4300	596	9	13	3	6364	3.2	60
Total-1	10,500					15,540		
M-2A	3400	176	16	13	3	5032	2.5	60
M-2B	3900	456	35	13	3	5772	2.9	60
M-2C	1800	496	37	13	3	2664	1.3	60
Total-2	9100					13,468	6.7	
M-3A	1500	280	5	13	3	2220	1.1	60
M-3B	4300	516	9	13	3	6364	3.2	60
M-3C	3000	776	30	13	3	4440	2.2	60
Total-3	8800					13,024	6.5	
M-4A	4600	312	25	13	3	6808	3.4	60
M-4B	2900	640	45	14	4	4843	3.2	60
M-4C	4900	1096	70	16	6	9996	4.5	60
Total-4	12,400					21,647	11.1	
M-5A	1500	112	11	13	3	2220	1.1	60
M-5B	1500	180	16	13	3	2220	1.1	60
M-5C	1900	284	23	13	3	2812	1.4	60
M-5D	2900	416	32	13	3	4292	2.1	60
Total-5	7800					11,544	5.7	

ENGINEERING AND DESIGN DATA

Area 6 - Georgetown - Johnson Chapel - Beneventum Plantation

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-1A	1300	52	1	13	3	1924	1.0	60
M-1B	3400	300	5	13	3	532	2.5	60
M-1C	1300	772	12	13	3	1924	1.0	60
L-1A	6700	1180	16	13	3	9916	4.9	60
M-1D	4600	2332	Present canal with proper maintenance will be adequate					
M-1E	2100	2572	Present canal with proper maintenance will be adequate					
L-2A	7400	452	8	13	3	10952	5.4	60
L-2B	1200	676	11	13	3	1776	0.9	60
L-2C	2800	760	12	13	3	4144	2.1	60
M-1F	4400	3872	Present canal with proper maintenance will be adequate					
L-3A	4800	424	7	13	3	7104	3.5	60
L-3B	3300	584	9	13	3	4884	2.4	60
L-4A	2100	196	4	13	3	3108	1.5	60
L-4B	5600	476	8	13	3	8288	4.1	60
L-3C	500	1104	16	13	3	740	0.4	60
L-3D	1800	1756	23	13	3	2664	1.3	60
L-5A	4600	244	20	13	3	6808	3.4	60
L-5B	600	280	23	13	3	888	0.4	60
L-6A	5800	512	37	13	3	8584	4.3	60
L-6B	2000	816	55	13	3	3700	1.7	60
L-6C	4500	1012	66	16	6	9180	4.1	60
L-5C	4200	1432	87	18	8	10122	4.4	60
L-3E	1600	3484	126	30	12	5040	2.1	65
L-3F	1600	3548	133	30	12	5040	2.1	65
M-1G	1700	7492	Present canal with proper maintenance will be adequate					
Total-1	79,900					107,318	53.5	

ENGINEERING AND DESIGN DATA

Area 6 - Georgetown - Johnson Chapel - Beneventum Plantation

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-2A	4100	332	26	13	3	6068	3.0	60
M-2B	1300	384	27	13	3	1924	1.0	60
L-1	4200	452	8	13	3	6216	3.1	60
M-2C	500	872	35	13	3	740	0.4	60
M-2D	4600	1388	41	13	3	6808	3.4	60
M-2E	700	1408	41	13	3	1036	0.5	60
L-2A	2700	232	4	13	3	3996	2.0	60
L-2B	3800	432	7	13	3	5624	2.8	60
L-2C	4900	668	10	13	3	7252	3.6	60
L-2D	1300	700	11	13	3	1924	1.0	60
L-3A	2600	136	3	13	3	3848	1.9	60
L-3B	3800	280	17	13	3	5624	2.8	60
L-2E	2000	1048	47	14	4	3340	1.6	60
M-2F	2000	2500	67	16	6	4080	1.8	60
L-4A	7900	548	9	13	3	11692	5.8	60
L-4B	1700	584	9	13	3	2516	1.2	60
M-2G	2400	3228	81	17	7	5328	2.4	60
L-5A	5900	428	7	13	3	8732	4.3	60
L-5B	2200	476	14	13	3	3256	1.6	60
M-2H	500	3828	94	18	8	1205	0.5	60
Total-2	59,100					91,209	44.7	
M-3A	7200	1388	18	13	3	10656	5.3	60
L-1	6000	992	15	13	3	8880	4.4	60
L-2	13000	1988	25	13	3	19240	9.5	60
M-3B	3600	4784	53	15	5	6660	3.1	60
M-3C	6200	5396	59	15	5	11470	5.4	60
Total-3	36,000					56,906	27.7	

ENGINEERING AND DESIGN DATA

Area 6 - Georgetown - Johnson Chapel - Beneventum Plantation

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-4A	1400	104	2	13	3	2072	1.0	60
M-4B	6600	532	8	13	3	9768	4.8	60
M-4C	5500	784	12	13	3	8140	4.0	60
L-1A	2900	252	4	13	3	4292	2.1	60
L-1B	3000	440	8	13	3	4440	2.2	60
M-4D	2900	1380	19	13	3	4292	2.1	60
L-2A	2600	96	2	13	3	3848	1.9	60
L-2B	1300	164	3	13	3	1924	1.0	60
L-2C	1200	208	4	13	3	1776	0.9	60
M-4E	4500	1904	25	13	3	6660	3.3	60
M-4F	1700	1936	25	13	3	2516	1.2	60
Total-4	33,600					49,728	24.5	
M-5A	3200	328	6	13	3	4736	2.4	60
M-5B	4600	788	41	13	3	6808	3.4	60
Total-5	7800					11,544	5.8	
M-6A	4600	180	3	13	3	6808	3.4	60
M-6B	1900	288	5	13	3	2812	1.4	60
M-6C	600	348	6	13	3	888	0.4	60
L-1A	1000	92	2	13	3	1480	0.7	60
L-1B	500	108	2	13	3	740	0.4	60
M-6D	2800	560	9	13	3	4144	2.1	60
Total-6	11,400					16,872	8.4	

ENGINEERING AND DESIGN DATA

Area 6 - Georgetown - Johnson Chapel - Beneventum Plantation

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-7A	7100	400	11	13	3	10508	5.2	60
Total-7	7100					10,508	5.2	
M-8A	2400	120	2	13	3	3552	1.8	60
M-8B	2700	200	4	13	3	3996	2.0	60
L-1A	5100	220	4	13	3	7548	3.7	60
L-1B	2500	300	5	13	3	3700	1.8	60
M-8C	2400	684	11	13	3	3552	1.8	60
Total-8	15,100						11.1	
M-9A	5000	160	3	13	3	7400	3.7	60
M-9B	2500	252	5	13	3	3700	1.8	60
Total-9	7500					11,100	5.5	

ENGINEERING AND DESIGN DATA

Area 7 - Murrell's Inlet - Pawleys Island - Hobcaw Plantation

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-1A	2600	140	13	13	3	3848	1.9	60
M-1B	2600	220	19	13	3	3848	1.9	60
Total-1	5200					7696	3.8	
M-2A	4200	280	23	13	3	6216	3.1	60
M-2B	1300	380	29	13	3	1924	1.0	60
Total-2	5500					8140	4.1	
M-3A	1900	120	11	13	3	2812	1.4	60
M-3B	5900	500	37	13	3	8732	4.3	60
M-3C	2700	760	54	13	3	3996	2.0	60
Total-3	10,500					15,540	7.7	
M-4	5200	200	17	13	3	7696	3.8	60
Total-4	5200					7696	3.8	
M-5A	2400	100	10	13	3	3552	1.8	60
M-5B	1300	130	12	13	3	1924	1.0	60
Total-5	3700					5476	2.8	
M-6	3700	200	17	13	3	5476	2.7	60
Total-6	3700					5476	2.7	
M-7A	1300	40	4	13	3	1924	1.0	60
M-7B	5300	290	24			7844	3.9	60
Total-7	6600					9768	4.9	
M-8	9000	660	11	13	3	13333	6.6	60
Total-8	9000					13,333	6.6	

ENGINEERING AND DESIGN DATA

Area 8 - Cedar Creek - Canon Bay - Little Kilsock Bay

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	CHANNEL DIMENSIONS BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-1A	3600	700	11	13	3	5328	2.6	60
M-1B	4000	1176	17			5920	2.9	60
M-1C	2500	1444	20			3700	1.8	60
M-1D	1700	1592	21			2516	1.2	60
M-1E	3900	2112	27			5772	2.9	60
M-1F	1500	2232	29			2220	1.1	60
L-1A	1800	568	9			2664	1.3	60
L-1B	2400	1064	15			3553	1.8	60
L-1C	2600	1652	22			3848	1.9	60
L-1D	3900	1968	26			5772	2.9	60
L-1E	3500	2628	33			5180	2.6	60
L-1F	10000	3604	42			14784	7.3	60
L-1G	1500	3684	43			2220	1.1	60
M-1G	7900	6920	67			16116	7.3	60
Total-1	50,800					79,593	38.7	
M-2A	2100	140	3			3108	1.5	60
M-2B	11600	928	14			17168	8.5	60
Total-2	13,700					20,276	10.0	

ENGINEERING AND DESIGN DATA

Area 8 - Cedar Creek - Canon Bay - Little Kilsock Bay

CANAL No. (1)	LENGTH Ft. (2)	WATERSHED Ac. (3)	DISCHARGE c.f.s. (4)	CHANNEL DIMENSIONS TOP WIDTH Ft. (5a)	BOTTOM WIDTH Ft. (5b)	EXCAVATION Cu. Yds. (6)	RT. OF WAY CLEARING Ac. (7)	REQUIRED RT. OF WAY WIDTH Ft. (8)
M-3A	4600	336	6	13	3	6808	3.4	60
M-3B	4500	504	8	13	3	6660	3.3	60
M-3C	2300	724	11	13	3	3404	1.7	60
L-1A	4000	388	7	13	3	5920	2.9	60
L-1B	2000	452	8	13	3	2960	1.5	60
L-1C	3200	1336	19	13	3	4736	2.4	60
M-3D	1500	2104	27	13	3	2220	1.1	60
Total-3	22,100					33,708	16.3	
M-4A	5100	784	12	13	3	7548	3.7	60
L-1A	1000	204	4	13	3	1480	0.7	60
L-1B	7600	1132	16	13	3	11248	5.6	60
M-4B	6200	1728	23	13	3	9176	4.6	60
M-4C	4900	4140	48	14	4	8183	3.9	60
Total-4	24,800					37,635	18.5	

ENGINEERING AND DESIGN DATA

Area 9 - Maryville - Big Kilsock Bay - North Santee - Annandale Plantation

CANAL	LENGTH	WATERSHED	DISCHARGE	CHANNEL DIMENSIONS TOP WIDTH	CHANNEL DIMENSIONS BOTTOM WIDTH	EXCAVATION	RT. OF WAY CLEARING	REQUIRED RT. OF WAY WIDTH
No. (1)	Ft. (2)	Ac. (3)	c.f.s. (4)	Ft. (5a)	Ft. (5b)	Cu. Yds. (6)	Ac. (7)	Ft. (8)
M-1A	6000	444	7	13	3	8880	4.4	60
L-1	5500	384	7	13	3	8140	4.0	60
M-1B	6900	1500	20	13	3	10212	5.1	60
M-1C	2500	1812	23	13	3	3700	1.8	60
L-2A	1600	164	3	13	3	2368	1.2	60
L-2B	2500	288	5	13	3	3700	1.8	60
L-2C	2900	496	8	13	3	4292	2.1	60
M-1D	8200	3120	34	13	3	12136	6.0	60
L-3A	1800	300	5	13	3	2664	1.3	60
L-3B	2300	604	9	13	3	3404	1.7	60
L-3C	5300	1000	15	13	3	7844	3.9	60
L-3D	1700	1052	15	13	3	2516	1.2	60
M-1E	1500	4236	49	14	4	2505	1.2	60
Total-1	48,700					72,361	35.7	
M-2A	7200	1256	18	13	3	10656	5.3	60
Total-2	7,200					10,656	5.3	
M-3A	3800	324	6	13	3	5624	2.8	60
Total-3	3,800					5.624	2.8	
M-4A	13500	1784	24	13	3	19980	9.9	60
M-4B	3000	1976	26	13	3	4440	2.2	60
Total-4	16,500					24,420	12.1	

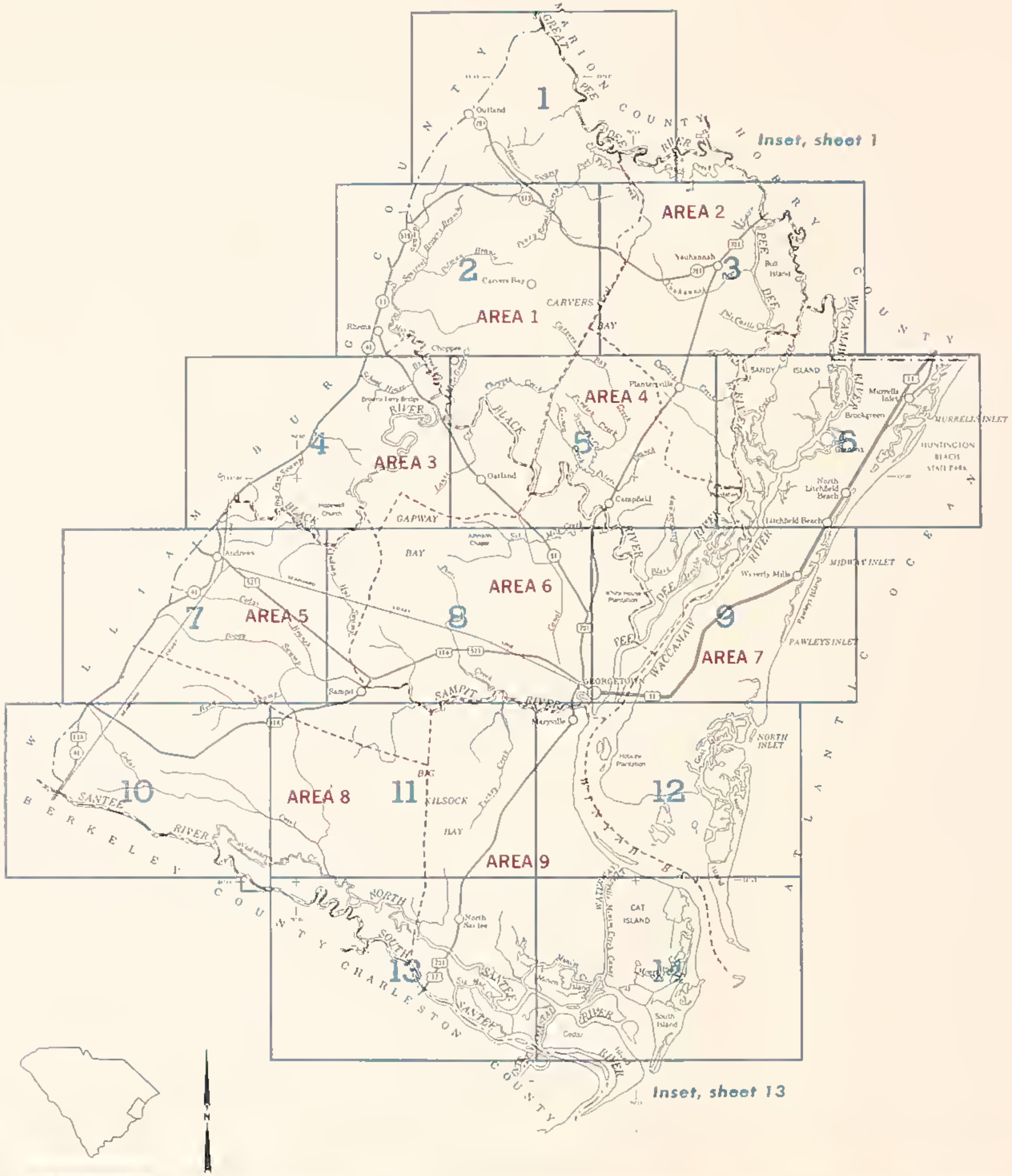
U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

INDEX TO ATLAS SHEETS
WATER RUNOFF STUDY
FOR
MAIN DRAINAGEWAYS AND OUTLETS
IN
GEORGETOWN COUNTY, SOUTH CAROLINA

0 6 12 18
Approximate Scale · Miles

0 10 20 30
Approximate Scale · Kilometers



LEGEND

Divided Highway

Primary Road

Federal Highway

State Highway

County Line

Planning Unit Boundary

Watershed Boundary

Sub-Watershed Boundary

M 2A Main

L 1A Lateral

SEPTEMBER 1979 4-37205

WATER RUNOFF STUDY FOR MAIN DRAINAGEWAYS AND OUTLETS IN GEORGETOWN COUNTY, SOUTH CAROLINA

County, South Carolina. The maps have been prepared in cooperation with Georgetown County Soil and Water Conservation District and under the financial sponsorship of Georgetown County. For information regarding the complete water runoff study report, write the Soil Conservation Service, U.S. Department of Agriculture, Columbia, South Carolina. This map was compiled as an uncontrolled mosaic from aerial photography flown in 1974 and 1975. Surveys were executed in 1979 and maps prepared in 1979.

0 1 MILE
0 5000 FEET
APPROXIMATE SCALE: 1:50,000
0 2000 METERS
0 2 KILOMETERS

SEPTEMBER 1979 4-R-37205

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WATER RUNOFF STUDY FOR MAIN DRAINAGEWAYS AND OUTLETS IN GEORGETOWN COUNTY, SOUTH CAROLINA

(Joins sheet 2)

(Joins sheet 5)

(Joins sheet 7) (Joins sheet 8)

0 1 MILE   0 5000 FEET   APPROXIMATE SCALE: 1:50,000   0 2000 METERS   0 2 KILOMETERS

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WATER RUNOFF STUDY FOR MAIN DRAINAGEWAYS AND OUTLETS IN GEORGETOWN COUNTY, SOUTH CAROLINA

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 9)

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(Joins sheet 4)

(Joins sheet 8)

(Joins sheet 10) (Joins sheet 11)

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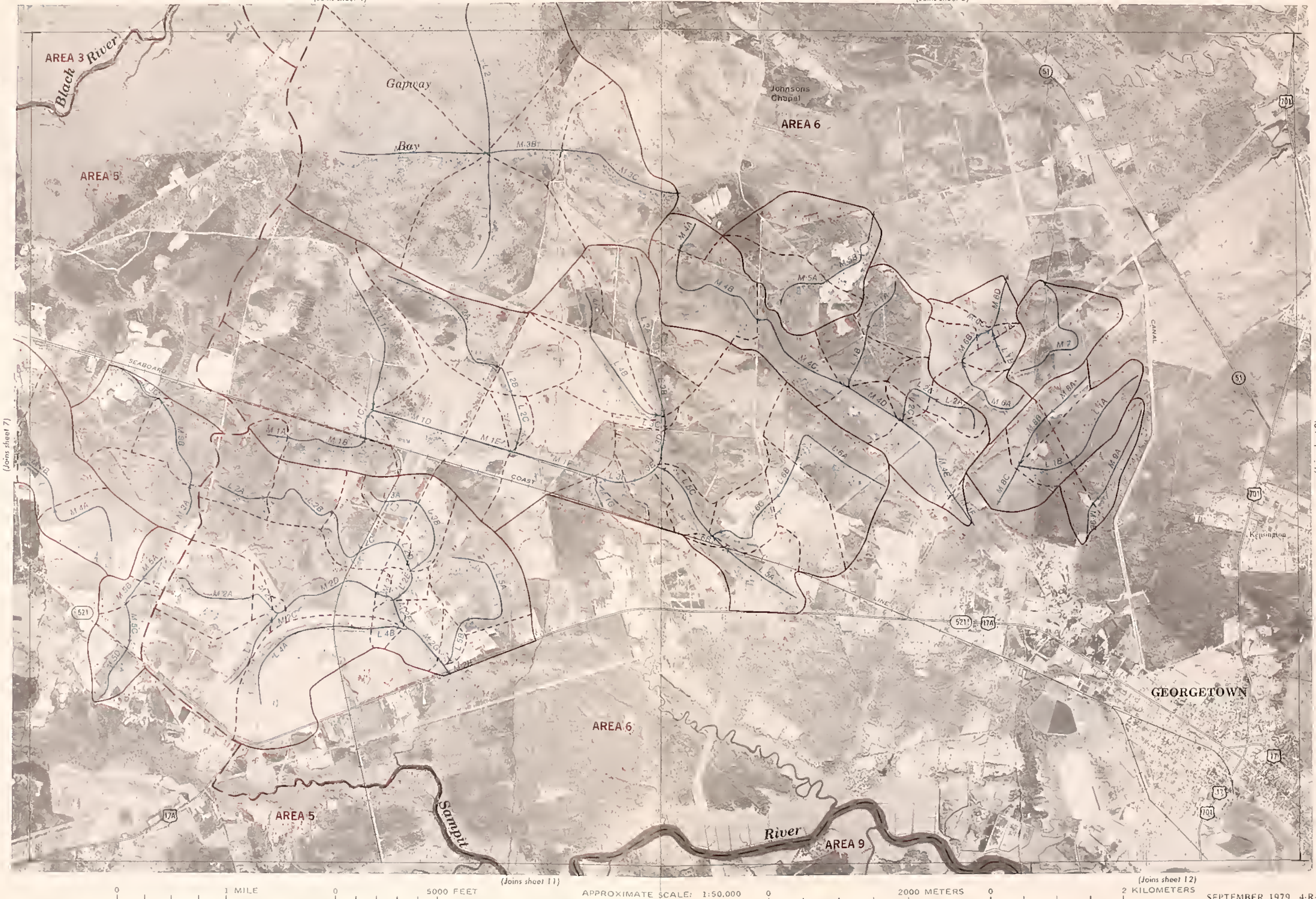

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WATER RUNOFF STUDY FOR MAIN DRAINAGEWAYS AND OUTLETS IN GEORGETOWN COUNTY, SOUTH CAROLINA

(Joins sheet 7)

(Joins sheet 11)

(Joins sheet 13)

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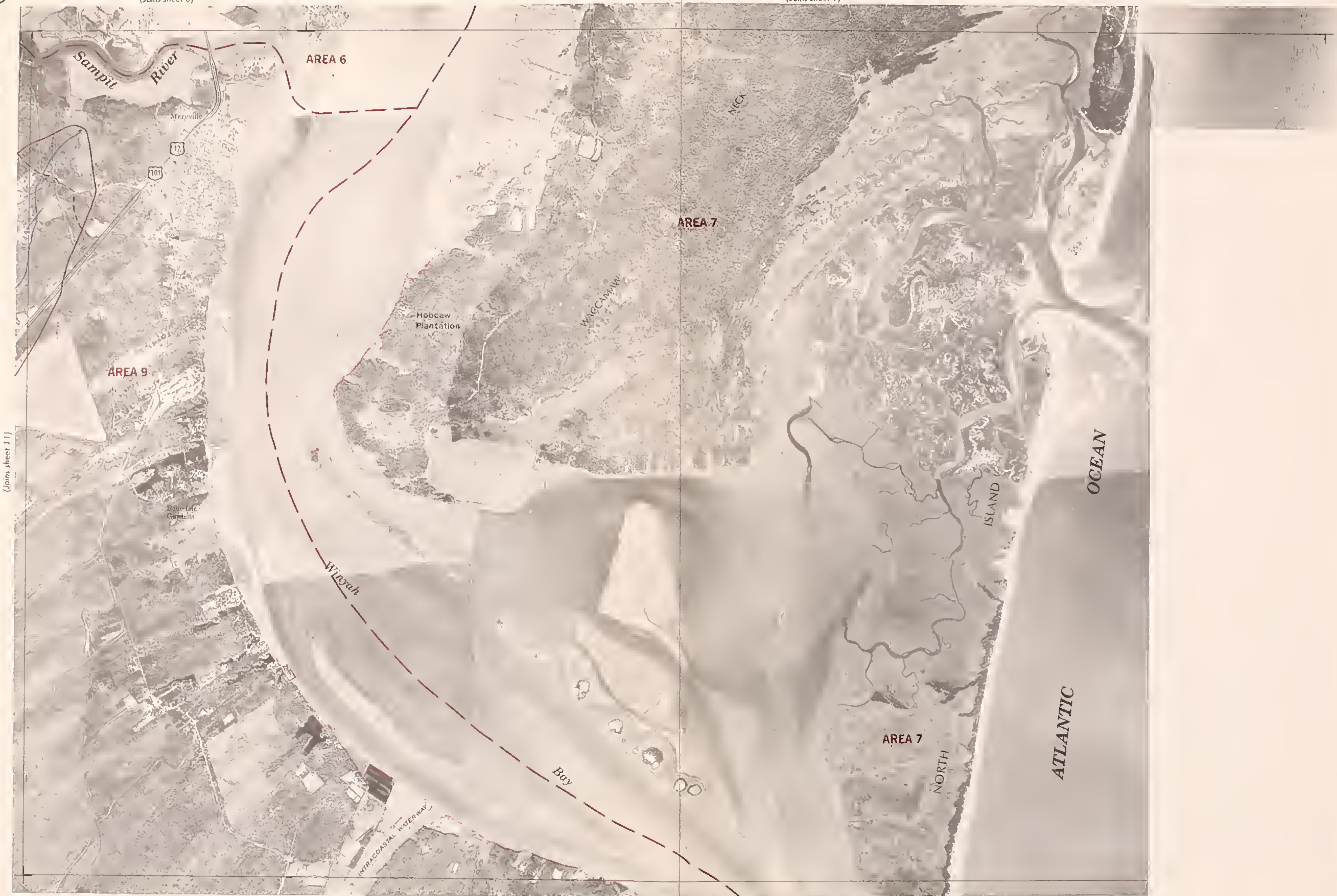

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